DEUTSCHER
FUSSBALL-BUND

FACT CHECK

PLAYING SURFACES

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IMPRINT

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1. INTRODUCTION

Outdoor playing areas can have different kinds of surfaces for the pitch. The classic, natural surface is natural turf. This consists of lawn grasses, while cinder pitches and synthetic turf areas consist of a water-bound cinder surface and an unfilled or filled synthetic turf surface respectively.

The types of surfaces have different properties as regards their play and protection function. Besides the on-site conditions, their intensity of use is decisively determined by the ground structure and professional care. The question of what the best possible playing surface is crops up repeatedly, but it is one that does not have a single, all-encompassing answer.

This fact check is intended to give you condensed information relevant to selecting the best possible surface and so help you make a decision based on use that is both financially and ecologically justified in the long term.

Furthermore, we also refer you to information previously published by the DFB on how to construct and care for pitches (see bibliography).

Fig. 1:
Match scene from the district league

2. PROPERTIES

2.1 NATURAL TURF PITCHES

Natural turf pitches consist of a plant cover formed by lawn grasses. The ground structure must meet the requirements for play and protection as well as for vegetation. From an ecological point of view, natural turf pitches are generally the best choice.

THESE ARE THE IMPORTANT RULES AND REGULATIONS:

Construction of grass sports fields:
DIN 18035 Sports grounds – Part 4 Turf areas (Beuth-Verlag, Berlin).

Care and use of grass sports fields:
Sports ground care guidelines – Guidelines for the care and use of outdoor sports facilities (only in German) (FLL, Bonn).

ADVANTAGES AND DISADVANTAGES OF GRASS SPORTS FIELDS

ADVANTAGES	DISADVANTAGES
• A natural playing surface with the optimal sports function and a highly challenging character • High protection function • Nearly unlimited service life • Stores rainfall • Binds CO2 • Produces oxygen • Has a temperature-regulating effect • No surface sealing	• Limited usability with waterlogged soil or frost or snow • Grass destroyed through overuse • Needs time to regrow • Requires a lot of maintenance

2.2 REINFORCED NATURAL TURF PITCHES (HYBRID SYSTEMS)

The play and protection properties of reinforced turf areas are basically comparable to those of natural turf pitches.

Hybrid systems for natural turf pitches can be roughly divided into two categories: hybrid turf base layers and hybrid turf. Both systems aim to increase the carrying capacity of natural turf pitches by reinforcing the turf and / or turf base layer and reducing the negative impacts of the load on the soil and / or grass.

In the case of hybrid turf base layers, synthetic fibres or synthetic fabric or other materials are mixed into the turf base layer for reinforcement. The basis is usually a turf base layer that either complies with DIN 18035-4 and / or the respective system is specified by the manufacturer.

With hybrid turf surfaces, synthetic fibres stabilise both the turf base layer and the turf itself. Some versions implant bundles of synthetic fibre into the natural grass; others use special synthetic turf mats, tufted or woven, as a carrier fabric for the fibres. In the amateur sector, hybrid turf systems are mainly used to reinforce the more heavily used areas of the pitch.

ADVANTAGES AND DISADVANTAGES OF REINFORCEMENT SYSTEMS

ADVANTAGES	DISADVANTAGES
Additional information on natural turf pitches: • Improved evenness • Higher carrying capacity with specially adapted care	**Additional information on natural turf pitches:** • Synthetic materials are introduced into the environment* • Harder surface • Higher maintenance costs • Disposal of reinforcing materials

* Synthetic fibres and microplastics through fibre abrasion

2.3 SYNTHETIC TURF SYSTEMS

In Germany, the construction of synthetic turf pitches is regulated in DIN 18035 Sports grounds – Part 7 Synthetic turf systems. DIN EN 15330-1 applies to the actual playing surface, the synthetic turf.

Three main synthetic turf systems can be considered for football use:

- → with sand filling;
- → with sand filling in combination with elastic filler (natural or synthetic);
- → unfilled synthetic turf.

ADVANTAGES AND DISADVANTAGES OF SYNTHETIC TURF SYSTEMS

ADVANTAGES	DISADVANTAGES
• Constant evenness • High carrying capacity • Can be used almost all year round • Lower maintenance costs compared to natural grass pitches	• Synthetic material (microplastics, fibre abrasion) enters into the environment* • High surface temperatures in summer • Limited service life, approx. 10-15 years, depending on intensity of use • High investment and renewal costs • Disposal of synthetic materials

* The resulting impacts on the environment and human health are not yet fully foreseeable. In line with the precautionary principle, the entry of microplastics into the environment should, therefore, be avoided. (Environmental Action Germany [Deutsche Umwelthilfe e.V. – DUH]) 2022).

2.4 CINDER PITCHES

A cinder surface is a water-bound surface whose play and protection properties are only given at a certain water content. The construction of such pitches is regulated in DIN 18035 Sports Fields – Part 5 Tamped areas.

ADVANTAGES AND DISADVANTAGES OF CINDER PITCHES

ADVANTAGES	DISADVANTAGES
• With appropriate water content, favourable sliding behaviour and favourable force reduction • High carrying capacity	• Greater risk of injury if skin comes into direct contact with the surface • Hard surface and dust formation with dry surface • Limited use when the surface is saturated with water and in frosty conditions

3. GROUND STRUCTURE

Ground structure refers to the different layers underneath the playing surface.

3.1 NATURAL TURF PITCHES

Depending on the location and use of the pitch, various construction methods can be considered. Ground-level construction methods make use of the favourable vegetation properties of the existing subsoil. Any additional drainage required for the pitch is ensured by drainage lines and / or drainage slots. On insufficiently permeable subsoil or in the event of very intense use, the drainage layer construction method can generally be considered. The requirements for the ground structure of natural turf pitches are regulated in DIN 18035 Sports grounds – Part 4 Turf areas.

3.2 HYBRID SYSTEMS

In general, the same requirements apply to the ground structure of hybrid systems as for natural turf pitches. In addition, depending on the reinforcement system, special manufacturer-dependent requirements for the ground structure must be observed.

3.3 SYNTHETIC TURF SYSTEMS

DIN 18035 Sports Grounds – Part 7 Synthetic Turf Systems regulates the requirements of the ground structure of a synthetic turf system. Particular attention must be paid to the elasticising layers, especially with regard to the required protection function of the surfacing.

3.4 CINDER PITCHES

DIN 18035 Sports Grounds - Part 5 Tamped areas regulates the requirements relating to the construction of a cinder pitch. With a few exceptions, large pitches are constructed from the ground up with a mineral base layer without a binder, a dynamic layer and the cinder surfacing.

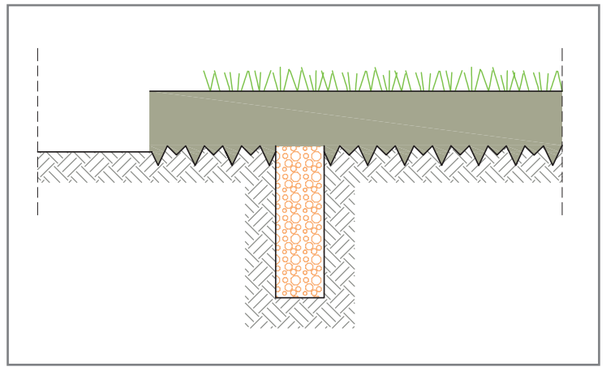

Fig. 2:
Drainage slot construction for natural turf pitches

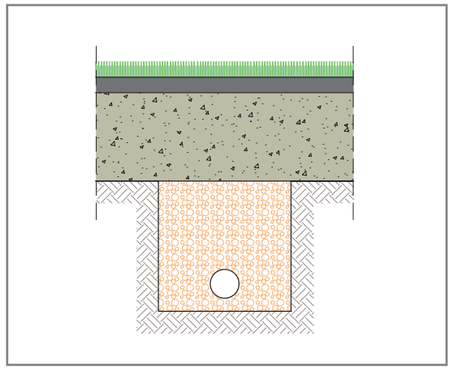

Fig. 3:
Synthetic turf pitch with bound elastic base layer

4. CARE

4.1 NATURAL TURF PITCHES

Natural turf pitches require continuous, professional care to maintain their play and protection functions. Besides mowing, fertilising and watering, this also includes mechanical measures, e. g. scarifying, harrowing, aerating, loosening, sanding and drag matting as well as re-seeding.

4.2 HYBRID SYSTEMS

Natural turf pitches with hybrid systems are intensively used pitches. That is why they also require more intensive care measures and have different care priorities. To maintain their function, checking the organic matter on the surface is a particularly essential task. Spreading sand on the pitch cannot take place, or only to a very limited extent, and the system hinders the deep loosening of the soil, too.

4.3 SYNTHETIC TURF SYSTEMS

Regular maintenance measures on synthetic turf pitches include the following: the removal of detritus and dirt (e. g. leaves, needles), evenly distributing and topping up the filling material (for backfilled coverings) and checking the seams. Intensive cleaning with special cleaning machines must be carried out at least once a year. In the event of intensive use and depending on its location, as well as when organic substances enter the system, this must be done more often.

In addition, the manufacturer's care recommendations must be observed.

4.4 CINDER PITCHES

Regularly recurring maintenance measures carried out on cinder pitches include the following: drag matting, levelling, sprinkling, rolling, repairing footpaths and cleaning.

The loosening and mixing of the cinder surface and the levelling of marking lines must be scheduled as irregularly recurring tasks.

5. USE

5.1 NATURAL TURF PITCHES

The intensity and frequency of use of a natural turf pitch depends not only on the ground structure but also, to a large extent, on the weather conditions. In the event of waterlogged ground, frost, snow or ice, use should be discontinued. Moreover, rest periods of several weeks to allow for regrowth must be taken into account. In practice, annual carrying capacity of up to 800 hours (use with spiked shoes) have proven to be a maximum figure. In individual cases and climatically favourable locations, longer periods of use are also possible. In regions with high levels of precipitation and at higher altitudes, the carrying capacity may be significantly lower.

Abb. 4:
Training im Winter auf Kunststoffrasen

5.2 HYBRID SYSTEMS

Reinforcement can extend the annual service life of the pitch while maintaining pitch quality. In the event of frost, snow or ice, the same usage restrictions apply as for non-reinforced natural turf pitches.

5.3 SYNTHETIC TURF SYSTEMS

Pitches made of synthetic turf can be used almost all year round. Only when the surface is frozen or icy should they not be used, especially from the point of view of its protection function. In practice, effective carrying capacities of about 1,500 hours per year are frequently encountered. More hours of use (up to 2,500 hours) are possible according to the FIFA Quality Product (Community Standard). However, such a high utilisation figure depends on the local frequency of use by clubs and schools, etc. and is rather rare. A damp surface during use improves the sliding friction behaviour.

5.4 CINDER PITCHES

The intensity of use of a professionally maintained and well-cared-for cinder pitch is comparable to that of a synthetic turf pitch. During periods of frost or thaw, use is restricted. A damp surface during use improves the sliding friction behaviour.

6. CONSTRUCTION AND CARE COSTS (AS OF 2021)

The construction and care costs listed below are based on the prices of 2021 and are subject to strong regional fluctuations. In addition, there are the current market economic influences to take into account, e. g. the availability of building materials. Construction costs (gross) are calculated from the top edge of the building site and apply to a playing field with a net playing area of 105 by 68 m including the safety zone (8,136 m²), barriers, sprinkler system, ball fence, training lighting and goals.

6.1 NATURAL TURF PITCHES

The following common construction methods can be considered for natural turf pitches:

- → Ground-level construction with pipe drainage: € 380,000
- → Ground-level construction with pipe / slot drainage: € 420,000
- → Construction with a flat drainage layer: € 480,000

The annual maintenance costs range from € 2.50 to € 4.00 per m².

6.2 HYBRID SYSTEMS

In general, the additional costs for reinforcing a complete playing field range from € 10 to € 30 per m².

The annual maintenance costs range from € 3.00 to € 4.50 per m².

6.3 SYNTHETIC TURF SYSTEMS

The cost range for constructing a synthetic turf pitch varies greatly depending on the system. As a general rule, the construction costs for a standard-sized, sand-filled pitch start at around € 650,000; for unfilled systems, estimates of € 800,000 and more are in order.

The annual maintenance costs are in the range of around € 1.50 to € 2.50 per m². Filled surfacing requires more care than unfilled surfacing.

6.4 CINDER PITCHES

The cost of constructing a new a standard-compliant cinder pitch is calculated to be around € 420,000.

Depending on the intensity of use, maintenance costs range from € 2.00 to € 2.50 per m².

7. DECISION-MAKING AIDS

7.1 BASIC CONSIDERATIONS

- The kind of sports played
- Sports trends over the next 15 to 20 years
- Number of teams
- Hours of use
- Training/point matches
- Financial resources (investment, maintenance, renewal)

In principle, the expertise of the state sports associations as well as that of sports field construction experts should be consulted when selecting the playing surface.

7.2 DECISION-MAKING MATRIX

The following matrix is intended to help you to decide what option to choose to give you the best possible playing surface. Since everyone has a different starting situation and basic considerations to take into account, you can also use the matrix to weight the criteria and subcriteria in line with your own circumstances.

Naturally, other criteria that play a role in the decision-making process can also be included. Care should be taken to ensure that the given grading scheme can be retained for evaluation purposes.

Overall, the surface with the highest score is preferable.

DECISION-MAKING MATRIX

CRITERIA			NATURAL TURF PITCHES		CINDER PITCHES		SYNTHETIC TURF PITCHES	
CRITERIA	SUBCRITERIA	WEIGHTING[1]	EVALUATION[2]	POINTS*	EVALUATION[2]	POINTS*	EVALUATION[2]	POINTS*
COSTS FOR	Construction							
	Care							
	Renovation, resurfacing							
	Disposal							
USABILITY	Hours per day							
	Hours per year							
	Positive health aspects							
	Quality of play							
ENVIRON-MENTAL IMPACTS	Resource consumption (production, use)							
	Water demand (use)							
	Negative micro-climate effects							
	Loss of natural soil functions							
OVERALL RATING[3] (TOTAL POINTS)								

1) The weighting of the subcriteria can be entered individually with a factor of between **1 (unimportant)** and **5 (very important)**.
2) **The ratings are allocated as follows:**

Costs:
1 = very expensive
2 = expensive
3 = average
4 = favourable
5 = very favourable

Usability:
1 = very low
2 = low
3 = average
4 = high
5 = very high

Environmental impacts:
1 = very high
2 = high
3 = average
4 = low
5 = very low

3) The higher the sum of the points, the more favourable the overall rating for the type of surface.

* = Weighting x Rating

FURTHER READING

BISP & DOSB (2020)
Füllstoffe in Kunststoffrasensystemen im Sport (Fillers in synthetic turf systems in sports – in German only)
Bundesinstitut für Sportwissenschaft, Bonn

BGL (2006)
Rasen- der natürliche Sportplatzbelag (Turf – the natural sports field surface – in German only)
Bundesverband Garten-, Landschafts- und Sportplatzbau e.V., Bad Honnef

DFB (2017)
Compendium on Sports Field Construction and Maintenance
German Football Association, Frankfurt am Main

DFB (2017)
Leitlinien zum Pflanzenschutz (Guidelines on plant protection – in German only)
German Football Association, Frankfurt am Main
Available under: DFB - LEITLINIEN ZUM PFLANZENSCHUTZ

DFB (2021)
DFB-Recommendations for Action for Football Clubs & Local Authorities – Microplastic Discharge from Existing Synthetic Turf Pitches
German Football Association, Frankfurt am Main
Available under: https://assets.dfb.de/uploads/000/256/883/original_DFB-Recommendations-Microplastic__2022.pdf?1647624173

DIN EN 15330-1
Surfaces for sports areas – Synthetic turf and needle-punched surfaces primarily designed for outdoor use – Part 1: Specification for synthetic turf surfaces for football, hockey, rugby union training, tennis and multi-sports use
Beuth-Verlag, Berlin

DIN 18035-4
Sports grounds – Part 4: Sports turf areas
Beuth-Verlag, Berlin

DIN 18035-5
Sports grounds – Part 5: Tamped areas
Beuth-Verlag, Berlin

DIN 18035-7
Sports grounds – Part 7: Synthetic turf areas
Beuth-Verlag, Berlin

DOSB (2020)
Handlungsempfehlungen bei Gestaltungen von neuen bzw. Betrieb von bestehenden Kunststoffrasensystemen mit Kunststoffgranulat als Füllstoff für Sportvereine und -Verbände sowie Kommunen. (Recommendations for the design of new or operation of existing synthetic turf systems with synthetic granulate as infill material for sports clubs and associations as well as municipalities – in German only)
German Olympic Sports Confederation, Frankfurt am Main

FIFA (2017)
Environmental impact study on artificial football turf
Zürich

FIFA
FIFA Quality Product (community standard)
Zürich

FLL (2022)
Fachbericht Kunststoffsportböden – Nachhaltige Kunststoffbelagsauswahl für Sportfreianlagen (Technical report synthetic sports surfaces – Sustainable synthetic surface selection for outdoor sports facilities – in German only)
Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V., Bonn

FLL (2014)
Richtlinien für die Pflege und Nutzung von Sportanlagen im Freien; Planungsgrundsätze (Guidelines for the care and use of outdoor sports facilities; planning principles – in German only)
Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V., Bonn

Öko-Institut e.V. (2008)
Ökobilanz für den Vergleich der Umweltauswirkungen von Natur- und Kunstrasenspielfeldern (Life cycle assessment for the comparison of the environmental impact of natural and artificial turf pitches – in German only)
Darmstadt

WWF (2020)
Mikroplastik ist überall (Microplastics are everywhere – in German only)
WWF Deutschland, Berlin
Available under: https://www.wwf.de/themen-projekte/plastik/mikroplastik

The WWF has published this study on the quantities of microplastics ingested by humans. According to this study, people all over the world consume an average of five grams per week. This is roughly equivalent to one shredded credit card. Therefore, further inputs of microplastics into the environment should be avoided wherever possible so that they do not continue to accumulate in ecosystems.

Zürcher Hochschule für Angewandte Wissenschaften (2020)
Ökobilanzierung von Rasensportfeldern: Natur-, Kunststoff- und Hybridrasen der Stadt Zürich im Vergleich (Life cycle analysis of turf sports grounds: natural, synthetic and hybrid turf of the city of Zurich in comparison – in German only)
Available under: https://digitalcollection.zhaw.ch/handle/11475/20774

Zürcher Hochschule für Angewandte Wissenschaften (2021)
Kennwertmodell Ökobilanz Rasensportfelder (Characteristic value model of the life cycle analysis for natural turf pitches – in German only)
Available under: https://bit.ly/3sCNbxT

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